



The Fc Orth(SA) final examination

How effective is the written component?

by

Stefan Swanepoel

Registrar, Department of Orthopaedic Surgery, Faculty of Health Sciences, University of Cape
Town

SWNSTE007

This study is in partial fulfilment of the requirements for the degree

Master of Medicine in Orthopaedic Surgery

University of Cape Town

Supervisor: Dr Michael Held

MD, PhD(Orth), FC Orth(SA), Department of Orthopaedic Surgery, Faculty of Health Sciences,
University of Cape Town

September 2018

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

DECLARATION

I, Stefan Swanepoel, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Signature:

Signed by candidate

Date: 31 September 2018

ACKNOWLEDGEMENTS AND CONTRIBUTIONS

Acknowledgements

To my wife and family for their support and patience.

To all the lecturers of the Department of Orthopaedics at UCT for their enthusiastic approach to practicing and teaching orthopaedics.

To Michael Held for his guidance with this project and teaching us how to be enthusiastic about research.

Contributions

The authors confirm that all authors have made substantial contribution to this manuscript.

Stefan Swanepoel	Data collection, processing and primary author.
------------------	---

Robert Dunn	Manuscript revision and editing.
-------------	----------------------------------

Juan Kloppe	Research idea, processing and statistical analysis.
-------------	---

Michael Held	Supervisor, manuscript revision and editing.
--------------	--

TABLE OF CONTENTS

	Page no:
Part A: Publication	6
Part B: Supporting documents	12

PART A:

PUBLICATION

EDUCATION

The FC Orth(SA) final examination: how effective is the written component?

Swanepoel S¹, Dunn R², Klopper J³, Held M⁴

¹ MBChB(UP), Registrar, Department of Orthopaedic Surgery, Faculty of Health Sciences, University of Cape Town, South Africa

² MBChB(UCT), MMed(Orth), FC Orth (SA); Professor and Head of Department of Orthopaedic Surgery, Faculty of Health Sciences, University of Cape Town, South Africa

³ MBChB, FCS(SA); Department of Surgery, Faculty of Health Sciences, University of Cape Town, South Africa

⁴ MD, PhD(Orth), FC Orth(SA), Department of Orthopaedic Surgery, Faculty of Health Sciences, University of Cape Town, South Africa

Corresponding author: Dr S Swanepoel, Department of Orthopaedic Surgery, Groote Schuur Hospital, Observatory, Cape Town 8000; email: swanepoeles@gmail.com; cell: 083 227 8594; work: 021 404 5108

Abstract

Background: To determine the pass rate of the final exit examination of the College of Orthopaedic Surgeons of South Africa [FC Orth(SA)] and to assess the correlation between the written component with the clinical and oral component.

Methods: Results of candidates who participated in the FC Orth(SA) final examination during a 12-year period from March 2005 through to November 2016 were assessed retrospectively. Pass rates and component averages were analysed using descriptive and inferential statistics. Spearman's rho test was used to determine the correlation between the components.

Results: A total of 399 candidates made 541 attempts at the written component of the examination; 71.5% of attempts were successful and 387 candidates were invited to the clinical and oral component, of which 341 (88%) candidates were certified. The second-attempt pass rate for those candidates who wrote the written component again was 42%. The average annual increase in the number of certified candidates was 8.5%. The overall certifying rate increased by 1.5% for this period. Invited candidates who scored less than 54% for the written component were at significant risk of failing the clinical and oral component. The written component showed weak correlation with the clinical and oral component ($r=0.48$).

Conclusion: While the written component was found to be an effective gatekeeper, as evidenced by a high eventual certifying rate, the results of this component of the FC Orth(SA) final examination did not correlate strongly with the performance in the clinical and oral component. This finding confirms the value of the written component as part of a comprehensive assessment for the quality of orthopaedic surgeons.

Level of evidence: Level 4

Key words: certification examinations, postgraduate training, orthopaedic surgery

Citation: Swanepoel S, Dunn R, Klopper J, Held M. The FC Orth(SA) final examination: how effective is the written component? SA Orthop J 2018;17(3):25-29.
<http://dx.doi.org/10.17159/2309-8309/2018/v17n3a2>

Editor: Prof LC Marais, University of KwaZulu-Natal, Durban

Received: December 2017

Accepted: February 2018

Published: August 2018

Copyright: © 2018 Swanepoel S. This is an open-access article distributed under the terms of the Creative Commons Attribution Licence, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Funding: The authors declare they received no funding for this research.

Conflict of interest: The authors declare that they have no conflicts of interest that are directly or indirectly related to the research.

Introduction and background

The urgent need to produce well-trained surgeons in low-middle income countries (LMIC) has recently been highlighted by the Lancet Commission on Global Surgery.¹ A crucial requisite to evaluate the quality of surgeons produced is a comprehensive specialist exit examination which confirms a candidate is fit to practice. In South Africa, orthopaedic surgical training is under the supervision of eight academic institutions. The Health Professions Council of South Africa (HPCSA) has appointed the Colleges of Medicine of South Africa as the designated unitary examination body to evaluate and certify successful candidates of the College of Orthopaedic Surgeons of South Africa [FC Orth(SA)] final examination. Candidates need to complete training time, produce a dissertation and pass the final composite examination to become a specialist.

Although this format seems well suited to assess the complexity of surgical competence, there is limited evidence in the surgical domain regarding the description of the examination processes with the majority of literature devoted to the psychometric adequacy of various assessment methods.^{2,3} Furthermore, the composite examination format is a labour- and resource-intensive undertaking and depends to a great degree on the feasibility regarding high cost, examiners' time, facilities and funds, especially for LMICs.^{4,5} With resource limitations in sub-Saharan Africa a reality, the focus is to minimise the administrative burden for examination bodies and therefore constantly re-evaluate and choose appropriate examination components which can still deliver the desired quality in selecting our surgeons.

The overall aim of this study was therefore to analyse and describe the results of the FC Orth(SA) final examination. Specific objectives were to assess the correlation between the written component with the clinical and oral components of the examination as well as to determine the overall certifying rate of those candidates who passed the written component. The written component functions as a gatekeeper, preventing candidates who fail this component from progressing to the clinical and oral component. In addition, the written component measures higher order cognitive skills which is different from the more clinical skills required in the oral and clinical components.⁶

Methods

A retrospective review of the FC Orth(SA) final examination results was conducted and all test results of this specialist examination from March 2005 through to November 2016 were included. No demographic data was available and the results of all candidates who were admitted to the written component were included in the analysis.

Examination structure

The FC Orth(SA) use a composite test format to assess candidates' knowledge and clinical skills. This examination comprises written papers, clinical cases and oral examinations (*Figure 1*).

During the period of this review, the written component consisted of three 3-hour papers with short- and essay-style questions.

The clinical component was composed of a long case with 30 minutes to interview and examine a non-standardised patient. The candidate then presented the case in 15 minutes to the examiners with an additional 15 minutes allocated for discussion around the case. These questions were not standardised. Furthermore, candidates were to examine two sets of short clinical cases, pathological cases as well as radiological material.

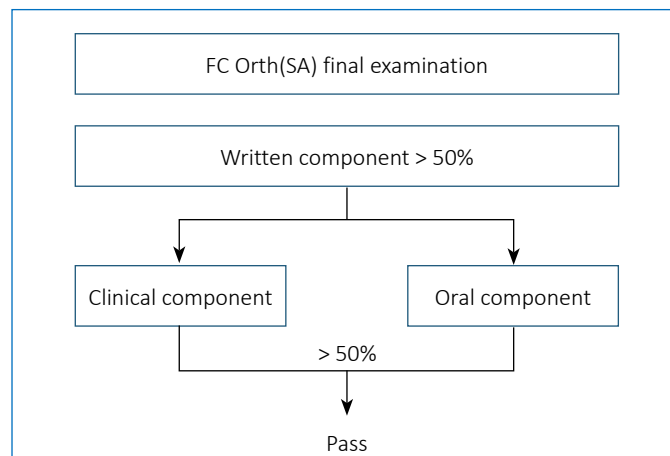


Figure 1. Flow chart illustrating the sequence of events in the examination process

The oral examination consisted of three 30-minute examinations. Each candidate was assessed separately by three teams of two examiners each. They covered orthopaedic trauma, reconstructive orthopaedic surgery and orthopaedic pathology.

The overall mark for each component reflected a score made up of marks from the three sub-components. All scores were expressed on a percentage scale. The set pass mark for the written examination was 50% and subsequently allowed for entry into the clinical and oral examination. The weighing of these two components were equal. Candidates were unsuccessful if they failed two or more sub-components or if their combined mark for the clinical and oral examination was less than 50%.

Statistical analysis

Descriptive and inferential statistics were performed using the Wolfram Programming Lab (Wolfram Research, Inc. Champaign, Illinois) to analyse the data. The Shapiro-Wilk test was used to determine the data distribution for the three components of the examination. Non-parametric tests were used to analyse and describe the various results of the examination components as the data was not normally distributed. Continuous variables were analysed using the Mann-Whitney test (when two sets of data were compared) or Kruskal-Wallis test (when more than two sets of data were compared). Spearman's rank correlation was used to describe the relationship between the different components of the examination. A *p*-value of <0.05 was accepted as statistically significant.

Results

During the 12-year period, a total of 399 candidates made 541 attempts at the written part of the examination. At this written component, 71.5% of attempts were successful and 387 candidates were invited to the clinical and oral component, of which 341 (88%) candidates were certified.

Figure 2 gives details of the number of candidates admitted to the written component, invited candidates to the clinical and oral component, and number of certified candidates. An average annual increase of 8.5% was observed in the number of successful candidates during this period.

Figure 3 shows the pass rates of the three components and the overall certifying rate for each year. The overall certifying rate increased by 1.5% during the period of this study. Eighty-six candidates made 141 repeat attempts at the written component. Sixty-six candidates eventually passed the examination at an

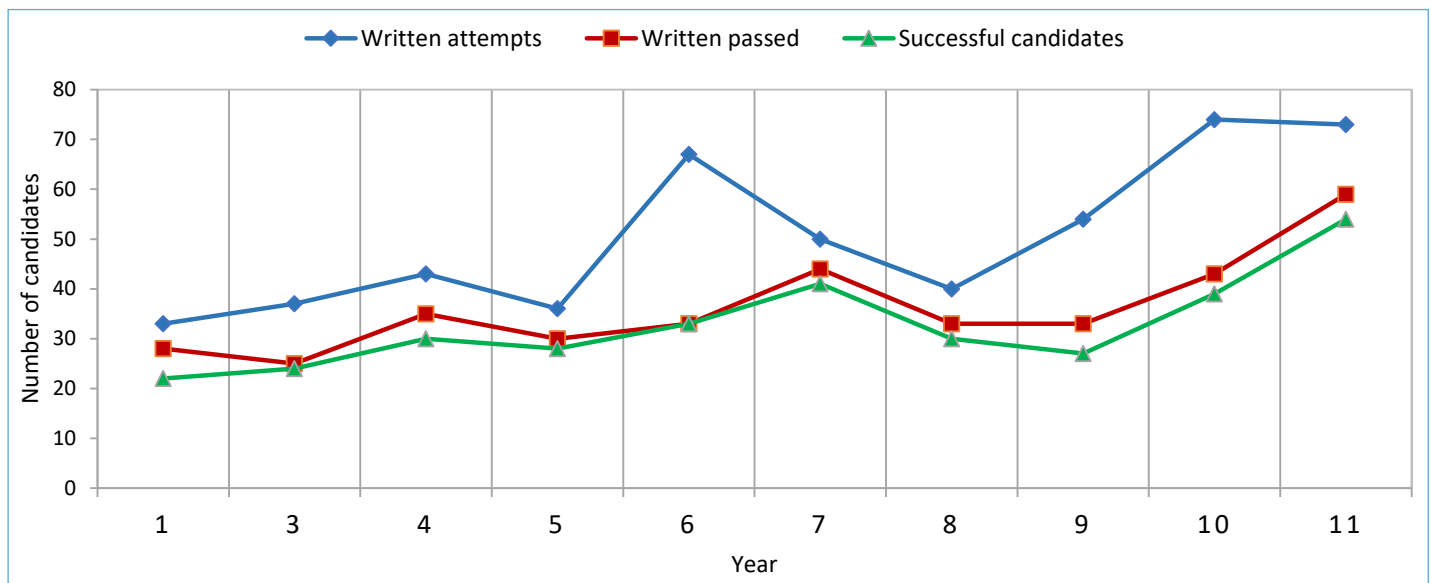


Figure 2. Line graph showing the annual volume of candidates admitted to the written examination, candidates invited to the clinical and oral component, and overall successful candidates

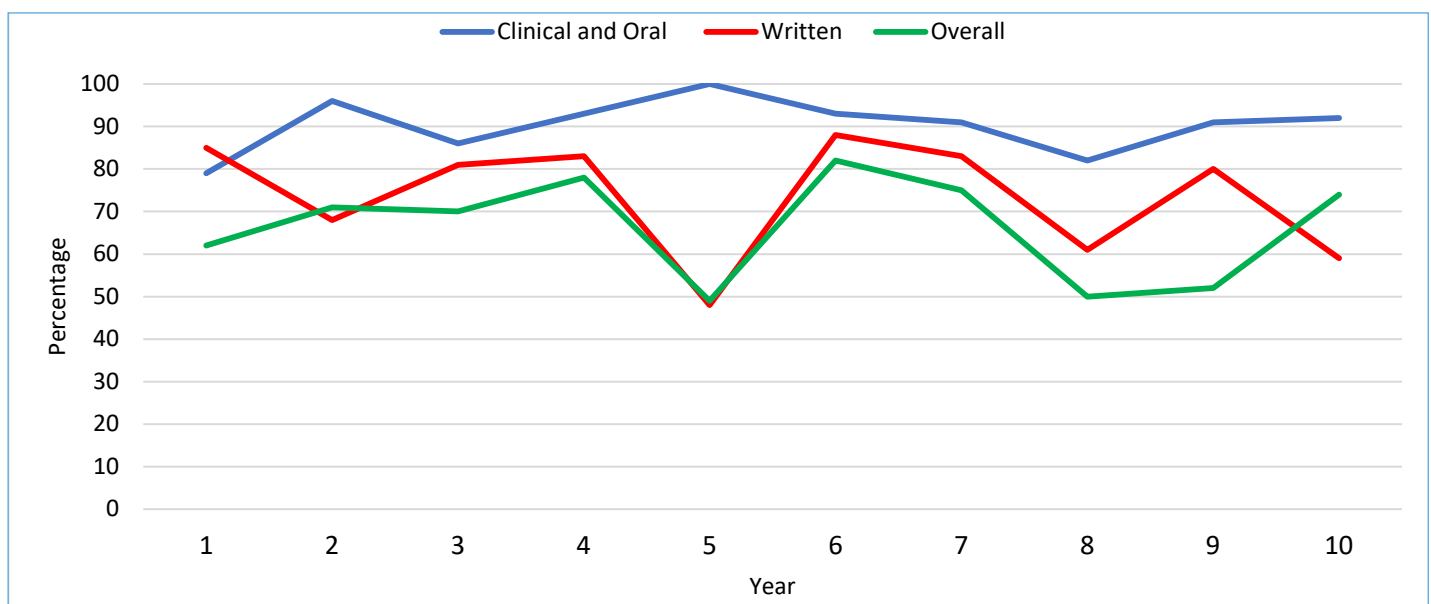


Figure 3. Line graph showing the annual pass rates of candidates admitted to the written examination, candidates invited to the clinical and oral component, and overall certifying rate

average of 2.5 attempts. The second-attempt pass rate for those candidates who attempted the written component again was 42%. Figure 4 shows the breakdown of the annual number of first- and second-attempt candidates who were successful in the FC Orth(SA) final examination.

The marks allocated for each component (written, clinical and oral) were analysed separately. Table 1 compares the average percentage scores of the sub-components. The average mark for the final examination was 60.1% (IQR 56–64%). There was a statistically significant difference when comparing the averages of the written, clinical and oral components, the three written papers, as well as the three clinical sub-components ($p < 0.05$). The averages for the three sub-components of the oral examination were similar ($p = 0.97$). Furthermore, the annual averages of the written, clinical and oral components showed marked variance ($p < 0.5$).

Candidates who passed the clinical and oral component scored significantly higher marks in the written component compared

to candidates who were unsuccessful in the oral or clinical component. The average marks were 59.6% (IQR 56–63.5%) compared to 54.1% (IQR 51–57%) respectively in the written component ($p < 0.05$). Sixty-nine per cent of candidates who were unsuccessful in the clinical and oral component failed due to poor performance in the clinical component of the examination.

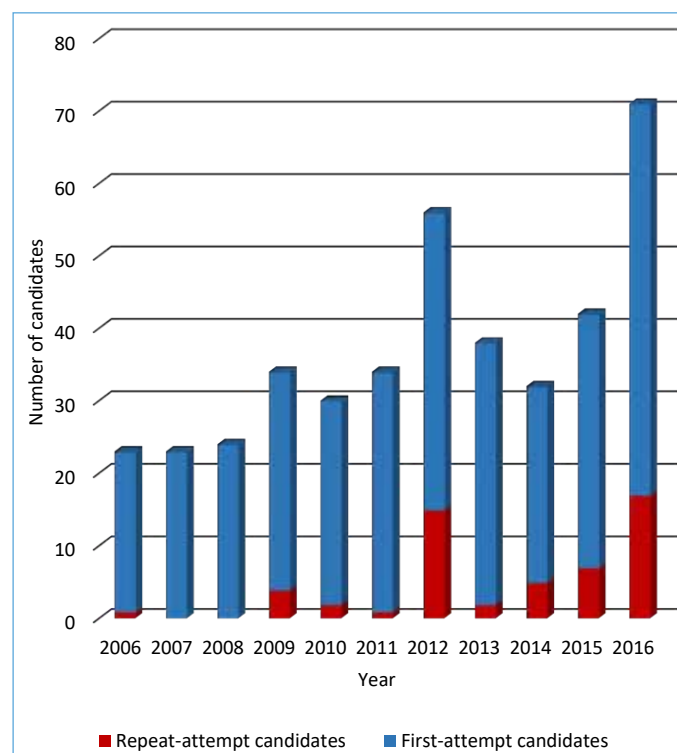
The components correlated poorly with each other ($p < 0.05$). The highest correlation coefficient was between the written and oral component ($r = 0.49$). The written component correlated poorly with the clinical component ($r = 0.33$) and showed a weak correlation with the combined clinical and oral mark ($r = 0.48$).

Discussion

This is the first reported study evaluating the outcomes of an orthopaedic surgery specialist examination in an LMIC. The present study shows that the results of the written component did

Table 1: Comparing the average mark of the sub-components of the written, clinical and oral examinations

	1	2	3	p-value
Written papers (IQR)	55 (48–62)	55 (48–62)	57 (51–64)	<0.05
Clinical cases (IQR)	60 (55–70)	57 (50–65)	59 (54–65)	<0.05
Oral examination (IQR)	60 (55–70)	60 (55–70)	60 (55–70)	0.97

**Figure 4.** Breakdown of first-attempt candidates and repeat-attempt candidates who were successful in the FC Orth(SA) final examination per annum

not correlate with the clinical and oral components; however, the written component was an effective gatekeeper as evidenced by the high certifying rate for candidates who passed this component. This finding confirms that the written component is an essential part of the composite examination process.

The poor correlation between the components likely indicates that the components are testing different aspects of competency. The essay-style questions in the written component were aimed at testing candidates' knowledge base and higher order cognitive processes when dealing with common orthopaedic problems.⁶ The long- and short-case clinical component aims to assess candidates' competency holistically by examining real patients with actual problems.⁷ This format requires candidates to display their knowledge, skills and judgement in a given sub-discipline. A possible explanation could be that the knowledge base tested in the written component has little relation to the more clinically based skills required by candidates for performance in the clinical and oral component of the examination. Deterioration of clinical examination skills among medical practitioners has been attributed to improvements in technology and a lack of time to properly examine patients.^{8,9} However, especially in resource-restricted countries, a thorough clinical examination remains an important skill in the armamentarium of healthcare professionals. It is postulated that the clinical examination component of an examination allows for evaluation of the effectiveness of a training programme and acts as a screening device to identify inadequately

trained candidates.⁷ In this study, 69% of candidates who were unsuccessful in the clinical and oral component of the examination failed due to poor performance in the clinical component of the examination. This finding might point out inefficiencies in the training programme and poor candidate preparation.

The FC Orth(SA) final examination uses the traditional pass mark of 50% for the written component. This pass mark appears to be generous given that candidates who scored less than 54% for this component were at significant risk of failing the clinical and oral component of this examination. This finding should be interpreted with caution due to the weak positive correlation found between the first and second parts of the examination. The significant variation observed in the annual average mark of the written component suggests differences in the cognitive ability levels between the groups of candidates for each examination sitting or could indicate the lack of standardisation of the examination between different hosting centres. The process of determining an appropriate pass mark to separate the competent candidate from those who do not perform well enough is called standard setting. In the absence of formal standard setting methods to improve the fairness of the set pass mark, variations in the level of difficulty of each examination could potentially lead to the misclassification of candidates. The ideal pass mark is the one in which unsuccessful candidates are truly incompetent and successful candidates are truly competent. For this reason the medical education literature strongly recommends formal standard setting procedures to improve the quality of high stakes certifying examinations and to ensure that the pass mark is robust and defensible especially in an era of increased litigation.¹⁰

There is limited literature on specialist certification processes and objective measures to improve it.¹¹ Historically assessment mainly focused on knowledge and know-how and less on skills and competencies. As the findings of our study were evident to the examination board, recent changes include the addition of an objective structured clinical examination (OSCE), multiple-choice questions (MCQ) with single best answers and extended matching questions. The introduction of an OSCE to the clinical component follows the international trend towards a more competency-based certification process.¹² To our knowledge this will be the first postgraduate orthopaedic surgery exit examination in Africa to include an OSCE as part of the certifying process. Currently the essay-style questions are in a process of being phased out of the written component of the FC (Orth)SA final examination and have been replaced by the more reliable and reproducible MCQ format.⁵ The MCQ assessment format is well known for its superior objectivity and allows for a wider sampling of a subject, which results in a more reproducible assessment and reduces the perception of examiner bias. These changes also served to improve the cost-effectiveness of the written component given the superior efficiency of their marking. The introduction of formal standard setting methods in the written and clinical components has also improved the credibility of pass/fail decisions.

More research is required to guide evaluation bodies in resource-constrained environments to ensure that their examination processes are evidence-based in order to provide a credible and defensible certifying examination.¹¹ The cost of the two-day assessment in the second part of the FC Orth(SA) examination is

enormous for the examination body and the candidates, and more research is required that will lead to cost-effective and goal-directed changes in the clinical and oral component. The limitations of this study include the lack of additional objective variables that may predict candidate performance in the FC Orth(SA) examination and future research could potentially include the appraisal of surgical logbooks, primary and intermediate examination results as well as annual in-training examination results. These predictors could potentially lead to the identification of inadequately trained candidates prior to the final examinations and the initiation of appropriate remedial action to improve their success rates.

Conclusion

This study confirms that the results of the written component did not correlate with performance in the clinical and oral component. This finding highlights the importance of the various components of this examination. The written component was found to be an effective gatekeeper, as evidenced by a high eventual certifying rate for candidates who passed this component. This study adds a contribution to the medical education literature describing the value of the written component in the composite examination format of a high-stakes postgraduate certification examination.

Ethics statement

Ethical approval was obtained from the institution's Human Research Ethics Committee.

References

1. Meara JG, Greenberg SLM. The Lancet Commission on Global Surgery Global surgery 2030: Evidence and solutions for achieving health, welfare and economic development. *Surgery*. 2014;**157**(5):834-35. doi:10.1016/j.surg.2015.02.009
2. Chou S, Lockyer J, Cole G, *et al.* Assessing postgraduate trainees in Canada: Are we achieving diversity in methods. *Medical Teacher*. 2016 (Oct);**31**:2, e58-e63. doi:10.1080/01421590802512938
3. Hutchinson L, Aitken P, Hayes T. Are medical postgraduate certification processes valid? A systematic review of the published evidence. *Med Educ* 2002;**36**:73-91. doi:10.1046/j.1365-2923.2002.01120.x
4. Rahman G. Appropriateness of using oral examination as an assessment method in medical or dental education. *Med Educ* 2011;**1**(2). doi:10.4103/0974-7761.103674
5. Turner JL, Dankoski ME. Objective structured clinical exams: a critical review. *Fam Med* 2008;**40**(8):574-78.
6. Hift RJ. Should essays and other open-ended-type questions retain a place in written summative assessment in clinical medicine? *BMC Medical Education* 2014;**14**:249. doi:10.1186/s12909-014-0249-2
7. Ponnampuruma GG, Karunathilake IM, Mcaleer S, Davis MH. Medical education in review. The long case and its modifications: a literature review. *Med Educ* 2009:936-41. doi:10.1111/j.1365-2923.2009.03448.x.
8. Feddock CA. The lost art of clinical skills. *Am J Med* 2007. doi:10.1016/j.amjmed.2007.01.023
9. Asif T, Mohiuddin A, Hasan B, Pauly RR. Importance of thorough physical examination: a lost art. *Cureus* 2017 (May);**9**(5):e1212. DOI 10.7759/cureus
10. Goldenberg MG, Garbens A, Szasz P, Hauer T, Grantcharov TP. Systematic review to establish absolute standards for technical performance in surgery. *Br J Surg* 2017:13-21. doi:10.1002/bjs.10313
11. Burch VC, Norman GR, Schmidt HG, van der Vleuten CPM. Are specialist certification examinations a reliable measure of physician competence? *Adv in Health Sci Educ* 2008:521-33. doi:10.1007/s10459-007-9063-5
12. Jonker G, Manders LA, Marty AP, *et al.* Variations in assessment and certification in postgraduate anaesthesia training: a European survey. *Br J Anaesth*. 2017 (Sept):1-6. doi:10.1093/bja/aex196

PART B:

SUPPORTING DOCUMENTS

ETHICS APPROVAL LETTER



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room "2-24 Old Main Building
Groote Schuur Hospital
Observatory 7925

Telephone [021] 404 7682 • Facsimile [021] 406 6411

Email: nosl.tsama@uct.ac.za

Website: www.health.uct.ac.za/ms/research/humanethics/fqms

28 February 2017

HREC REF: 079/2017

Dr M Held

Orthopaedics Surgery

H49, Old Main Building

Dear Dr Held

PROJECT TITLE: A RETROSPECTIVE AUDIT OF THE OUTCOMES OF THE FC ORTH (SA) FINAL EXAMINATION (MMED CANDIDATE - DR S SWANEPOEL)

Thank you for submitting your response letter to the Faculty of Health Sciences Human Research Ethics Committee dated 21 February 2017.

It is a pleasure to inform you that the HREC has formally approved the above-mentioned study.

Approval is granted for one year until the 28th February 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student Dr S Swanepoel will be involved in this study.

Please note that for all studies approved by the HREC, the principal Investigator must obtain appropriate institutional approval before the research may occur.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal

Investigator.

Yours sincerely

Signature Removed

PROFESSOR M BLOCKMAN

CHAIRPERSON. FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB00001938

H REC 079/2017

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on

Harmonisation Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DOH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH

Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

INSTRUCTIONS FOR AUTHORS

- [Scope and Policy](#)
- [Formatting of Submissions](#)
- [Instructions for Reviewers](#)
- [Manuscripts Submission](#)

Scope and Policy

The scope of publication encompasses all orthopaedic surgery sub-disciplines including paediatric orthopaedics, hip, knee, tumour and sepsis, spine, shoulder and elbow, foot and ankle and hand surgery. In addition the journal addresses the subjects of orthopaedic service delivery, teaching, training and research. Publications should influence orthopaedic care on our continent.

The *South African Orthopaedic Journal* aims to advance the knowledge of all aspects of musculoskeletal medicine through publication of:

- Original research articles.
 - Clinical research
 - Basic science and theoretical research
- Review articles.
- Invited expert opinions.
 - A review of significant local or international publications journal article or cluster of articles dealing with a similar topic for the purpose of conveying a useful message.
- Editorials.
- Letters to the editor.
 - Forum to raise issues or debate aspects of previously published papers.

Criteria for publication

- The article falls within the scope of the journal.
- Methods, statistics, and other analyses are performed to a high technical standard and are described in sufficient detail.
- Results reported have not been published elsewhere.
- Conclusions are presented in an appropriate fashion and are supported by the data.
- The article is presented in an intelligible fashion and is written in standard English (British usage).
- The research meets all applicable ethical standards.
- The article adheres to guidelines provided in the instructions for authors section.

Guidelines for authorship

- Each author should participate and is responsible for the content and design of the study, the preparation of the manuscript and its revisions, and final approval.
- Other 'contributors' can be acknowledged at the end of the manuscript together with their contribution.
- Authors of manuscripts representing a multi-centre study may list members of the group in the footnote on the title page of the published article and their affiliations are listed in an appendix.
- The authors should clearly indicate the predominant surgeon or surgeons who have contributed patients to the study.

Registration of clinical trials

- A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Interventions include drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes.
- Clinical trials should be registered in a public trials registry in accordance with International Committee of Medical Journal Editors recommendations.
- Trials must be registered and approved by the relevant authorities before the onset of patient enrolment.
- The Medicines Control Council (MCC) reference number and the SA National Clinical Trial Register (SANCTR) registration number should be included at the end of the abstract of the article.
- Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) do not require registration.

Reporting guidelines

- All articles should be prepared in accordance with the guidelines relevant to the study design that was used (listed below):

Randomised trials	CONSORT
Observational studies	STROBE
Systematic reviews	PRISMA
Case reports	CARE

Qualitative research	SRQR
Diagnostic / prognostic studies	STARD
Quality improvement studies	SQUIRE
Economic evaluations	CHEERS
Animal pre-clinical studies	ARRIVE
Study protocols	SPIRIT

-
- Randomised trials should be accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrolment, randomisation, withdrawal and completion, and a detailed description of the randomisation procedure.

Role of funding source

- Authors are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement, then this should be stated.

Formatting of Submissions

Text formatting

- Use Helvetica or Arial font, size 11.
- Use double line spacing throughout the document.
- Number the pages of the blinded manuscript consecutively.
- Use italics for emphasis.
- When referring to an article with multiple authors please use the following format: Rabinowitz *et al.* published their retrospective review.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.
- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

Headings

- Use no more than three levels of displayed headings.

Abbreviations

- Define abbreviations and acronyms at first mention and use consistently thereafter.

Units

- Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

Figures

- Figures should be numbered consecutively with illustration Arabic numbers 1, 2, 3, etc.
- The figure should be listed in the text as follows: ... wound irrigation and splinting (*Figure 1*).
- Figures should be clear and easily understandable with a full descriptive legend stating any areas of interest and explaining any markings, letterings or notations. All figures should be understandable without the main text.
- For radiographs please ensure you state the view used and the time point at which it was taken, as well as the demographic details of the patient if applicable.
- Figures should not be imbedded in the text file, but should be submitted as separate individual files. Each figure should be a separate file, entitled Figure 1, Figure 2, etc.
- Remove all markings, such as patient identification, from radiographs before photographing.
- All line or original drawings must be done by a professional medical illustrator.
- We accept a maximum of six figures.
- Do not submit any figures, photos, tables, or other works that have been previously copyrighted or that contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

Tables

- Tables should carry uppercase Roman numerals, I, II, III, etc.
- Tables should always be cited in the text in consecutive numerical order.
- The table should be identified in the text as follows: Details of results are listed in *Table I*. Or, alternatively, ... high-energy trauma that is often associated with these fractures (*Table II*).
- Tables should be used to present information in a clear and concise manner. All tables should be understandable without the main text.
- For each table, please supply a table heading explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table heading.
- Footnotes to tables should be indicated by superscript lower-case letters and included beneath the table body.

- Please submit tables as editable text and not as images. They should be created using the Table tool in Word.
- Do not embed tables in the text file, but submit them as separate individual files. Each table should be a separate file, entitled Table I, Table II, etc.
- We accept a maximum of eight tables.
- Do not duplicate information given already in the text.
- Do not submit any figures, photos, tables or other works that have been previously copyrighted or that contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

References

- References should be numbered consecutively in the order that they are first mentioned in the text and listed at the end in numerical order of appearance.
- Identify references in the text by Arabic numerals in superscript after punctuation.
- References should not be a listing of a computerised literature search but should have been read by the authors and have pertinence to the manuscript.
- Authors should add DOIs to all references in articles.
- Accuracy of references is the author's responsibility and the author is to verify the references against the original documents.
- Manuscripts in preparation, unpublished data (including articles submitted but not in the press) and personal communications may not be included in the reference listing. They may be listed in the text in parentheses only if absolutely necessary to the contents and meaning of the article.
- The titles of journals should be abbreviated according to the style used in Index Medicus, obtainable through the website <http://www.nlm.nih.gov/should>
- The following format should be used for references:

Journal article:

Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE.
Civilian gunshot injuries of the spinal cord: a systematic
review of the current literature. Clin Orthop Relat Res
2013;471:3945-55.

Ideally, the names of all authors should be provided, but
the usage of 'et al.' in long author lists (more than six
authors) will also be accepted: Fong K, Truong V, Foote
CJ, et al. Predictors of nonunion and reoperation in
patients with fractures of the tibia: an observational study.
BMC Musculoskelet Disord 2013;14:103.

On-line journal article:

Caetano-Lopes J, Lopes A, Rodrigues A, et al.
Upregulation of inflammatory genes and downregulation of
sclerostin gene expression are key elements in the early
phase of fragility fracture healing. PLoS One
2011;6:e16947.

Web reference (with authors):

Cierny G, DiPasquale D. Adult osteomyelitis protocol.
http://www.osteomyelitis.com/pdf/treatment_protocol.pdf.
(date last accessed 05 March 2013).

Web reference (no authors listed):

No authors listed. International commission on radiological protection. <http://www.icrp.org> (date last accessed 20 September 2009).

Chapter in a book:

Young W. Neurophysiology of spinal cord injury. In: Errico TJ, Bauer RD, Waugh T (eds). Spinal Trauma. 3rd ed. Philadelphia: JB Lippincott; 1991: 377-94.

Dissertation:

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

Abstract:

Peterson L. Osteochondritis of the knee treated with autologous chondrocyte transplantation [abstract]. ISAKOS Congress, 2001.

Structure and content of submission

- We accept a maximum of 3500 words including the abstract and body of the text (excluding references).
- Exceptions to this rule may be made for systematic reviews and meta-analysis, at the discretion of the Editor-in-Chief.
- Please follow the following structure when preparing your submission.
 - Title page (Title, authors and affiliations, corresponding author and declarations)
 - Blinded manuscript (Abstract, key words, introduction, methods, results, discussion, funding sources, conflict of interest statement, ethical statement, acknowledgements and references)
 - Tables (with headings), each as a separate file.
 - Figures (with legends), each as a separate file.

Title page

Title

- The title should be concise and informative.

Author names and affiliations

- Please provide the following information for each author:
 - Full names and surname, as well as title
 - Qualifications
 - Affiliation and address
 - ORCID ID (see Article Submission section)
- Please check that all names are accurately spelled.

- Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate affiliation details.
- Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

Corresponding author

- Clearly indicate who will handle correspondence at all stages of refereeing and publication, including post-publication.
- Ensure that the e-mail address and permanent address is given and that contact details are kept up to date by the corresponding author.
- Please note that the corresponding author's contact details will be provided in the final article.
- Provide the following information for the corresponding author:
 - Full names and title
 - Affiliation
 - Physical address
 - Postal address
 - Telephone Number
 - E-mail address

Declarations

Authors are to insert a section at the end of the title page entitled declarations. Following the declarations all authors need to sign the document (please provide name of author, signature and date). The following statements are required under the declarations section:

a. Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

- The conception and design of the study, or acquisition of data, or analysis and interpretation of data
- The drafting the article or its critical revision for important intellectual content
- Final approval of the version to be submitted.

b. Sound scientific research practice

The authors further confirm that:

- The manuscript, including related data, figures and tables has not been previously published and is not under consideration elsewhere
- No data have been fabricated or manipulated (including images) to support conclusions.
- This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. 'salami-publishing').

c. Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

- No data, text or theories by others are presented as if they were the authors' own.
- Proper acknowledgements of others' work has been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
- Permissions have been secured for material that is copyrighted.

d. Conflict of interest statement

A conflicting interest exists when professional judgement concerning a primary interest (such as the patient's welfare or the validity of research) may be influenced by a secondary interest (such as financial gain or personal rivalry). It represents a situation in which financial or other personal considerations from authors, reviewers or editors have the potential to compromise or bias professional judgment and objectivity. It may arise for the authors when they have a financial interest that may influence their interpretation of their results or those of others. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. All potential conflicts of interest need to be declared. The conflict of interest statement should list each author separately by name, i.e.,

'John Smith declares that he has no conflict of interest.
Paula Taylor has received research grants from Drug
Company A. Mike Schultz has received a speaker
honorarium from Drug Company B and owns stock in Drug
Company C.'

If multiple authors declare no conflict, this can be done in one sentence.

e. Funding sources

All sources of funding should be declared. Also define the involvement of study sponsors in the study design, collection, analysis and interpretation of data; the writing of the manuscript; and the decision to submit the manuscript for publication. If the study sponsors had no such involvement, this should be stated.

f. Compliance with ethical guidelines

- For all publications:

'The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.'

Available from:

<http://publicationethics.org/resources/international-standards-for-editors-and-authors>

Institutional Review Board (IRB) ethical approval must have been given if the study involves human subjects or animals. Please provide the approval number. IRB documentation should be available upon request.

'Prior to commencement of the study ethical approval was obtained from the following ethical review board: *Provide name and reference number*'

- For studies with human subjects include the following:
'All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.'
- 'Informed written consent was or was not obtained from all patients for being included in the study.'
- For studies with animals include the following sentence:
'All institutional and national guidelines for the care and use of laboratory animals were followed.'
- For articles that do not contain studies with human or animal subjects:
'This article does not contain any studies with human or animal subjects.'
- If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach, and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. If any identifying information about patients is included in the article, the following sentence should also be included: Additional informed consent was obtained from all patients for which identifying information is included in this article.

The Helsinki Declaration 2008 can be found at

<http://www.wma.net/en/30publications/10policies/b3/>

Blinded manuscript

Abstract

- A structured abstract (maximum of 350 words), summarising the most important points in the article is required.
- The abstract consists of four paragraphs with the subheadings:
 - Aims (it is unnecessary to include an introductory section)
 - Patients and methods
 - Results
 - Conclusion
- References should be avoided. Avoid uncommon abbreviations. If essential they must be defined at their first mention in the abstract itself

Key words

- Immediately after the abstract, provide a maximum of six key words, using standard searchable terms. These key words will be used for indexing purposes.

Level of evidence

- Level 1 to 5.
- Please follow the level of evidence guidelines provided by the Oxford Centre for Evidence-Based Medicine (OCEBM); version 2.1.
- Available from: OCEBM Levels of Evidence Working Group. 'The Oxford Levels of Evidence 2'. Oxford Centre for Evidence-Based Medicine.
<http://www.cebm.net/index.aspx?o=5653>

Introduction

- The introduction should contextualise the study by providing the background to the research; explain the problem that is to be addressed and provide the rationale for the study.
- Briefly outline the relevance of the study with respect to the current literature. Avoid a detailed literature survey or a summary of the results.
- The last sentence should outline the research question or hypothesis.

Patients (or Materials) and methods

- State the methods, outcome measures, and selection criteria. The following aspects need to be described:
 - The study design and research methodology
 - Whether randomisation (with methods) was applied
 - If case controlled, how the controls were selected
 - The time period under review
 - Number of patients/subjects under investigation and why this number was chosen
 - Inclusion and exclusion criteria
 - Case and outcome definitions
 - A description of the procedure or intervention, including post-operative protocol
 - The outcome measures or scores used
 - The minimum follow-up period
 - Statistical analysis paragraph. This should be included at the end of this section to detail statistical tests and package used, the reasons why these tests were used, and what p-value was considered statistically significant. A power analysis is recommended for studies comparing two or more groups.
- Provide sufficient detail so that another researcher can replicate the study.
- The reader should understand from this description all potential sources of bias such as referral, diagnosis, exclusion, recall or treatment bias. This includes the manner in which investigators selected the patients. Consecutive inclusion implies all patients with a given diagnosis are included, while selective implies patients with a given diagnosis but

selected according to certain explicit criteria (e.g., state of disease, choice of treatment).

- Do not describe standard procedure for common operations. Only include new procedures or adaptations to standard procedure.
- If you name any specific product, then it requires the name, city and state/country of the manufacturer.
- Present information in the narrative format and use the past tense.
- Where relevant, tables or figures may be included to provide information more clearly.
- Generally, no data should be presented in this section.

Results

- Describe the relevant results and analysis thereof.
- Provide details of the number of patients included and excluded, as well as the reason for exclusion.
- It is important to state the follow-up period (mean and range).
- The results can be broken down into separate sections, e.g. Treatment, Functional outcome, Complications, etc.
- Tables may be used but avoid repeating data reported in the text in the tables.
- All appropriate data should be presented as means with ranges, not with standard deviations (SDs). Medians should only be used when the data is skewed, accompanied by an interquartile range (IQR).
- Avoid using percentages in studies involving well under 100 subjects.
- All results must be backed up with p-values or survivorship analysis. All Kaplan-Meier data should be presented with the confidence intervals. Always present exact absolute p-values, whether significant or not, unless $p < 0.001$.
- However, p-values do not always convey the entire picture and where relevant the confidence interval will also be required (in addition to the power of the study reported in the methods section).

Discussion

- The question or hypothesis stated at the end of the introduction should be discussed and either supported or rejected.
- The results must be interpreted clearly and any deficiencies expressed. All possible confounding factors, sources of bias, or weaknesses in the study should be identified.
- Explore the significance of the results of the work, rather than repeating the results.
- The discussion must point out the relevance of the work described in the paper and its contribution to current knowledge.
- Explain what can be deduced from the results and how will it affect clinical practice.
- Include a review of the relevant literature, placing the results of the study in the context of previous work in this area.
- Discussion of relevant prior research and references must be concise. Avoid extensive citations and discussion of published literature but put emphasis on previous findings that agree (or disagree) with those of the present study.
- Do not repeat the introduction.
- Present the limitations of the study and suggest how the study could have been improved for a future study.

- Avoid making inferences from non-significant trends unless you believe your study is adequately powered to answer the question; in that case, provide a power analysis.

Conclusion

- Provide a summary statement which conveys the conclusions of the findings.
- Do not draw conclusions not supported by the data obtained from the specific study presented.

Conflict of interest

- 'Author A.B. (use initials of relevant author, not full name in order for the document to remain blinded) has received research grants from Company A. Author B.C. has received a speaker honorarium from Company X and owns stock in Company Y. Author C.D. is a member of committee Z.'
- If no conflicts of interest exist, state this as follows: 'The authors declare they have no conflicts of interest that are directly or indirectly related to the research.'

Ethical statement

- For studies involving human subjects please include an ethical statement as follows: 'All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.'
- For animal studies please include the following ethical statement: 'All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.'
- If the study did not involve human or animal subjects state that: 'This article does not contain any studies with human participants or animals performed by any of the authors.'
- Please also include an informed consent statement: 'Informed consent was obtained from all individual participants included in the study.'
- Or alternatively, for retrospective studies, please add the following sentence: 'For this study formal consent was not required.'
- If identifying information about participants is available in the article, the following statement should be included: 'Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.'

Funding sources

- List all funding sources as follows: 'This work was supported by the xxxx (grant numbers xxxx, yyyy).'
- When funding is from a block grant or other resources available to a university, college or other research institution, submit the name of the institute or organisation that provided the funding.
- If no funding was received, state as follows: 'No funding was received for this study.'

Acknowledgements

- Acknowledgements should be placed at the end of the discussion and before the references.
- In this section persons who were involved but did not earn authorship can be acknowledged.
- Statements should be brief. A person can be thanked for assistance or for comments.
- Should not include contributions by editors or referees.

References

- Please refer to the section on Formatting of submissions.

Tables and figures

- Table and figures should not be imbedded in the text file, but should be submitted as separate individual files. Each table should be a separate file, entitled Table I, Figure 2, etc.
- Each table and figure should be provided with a heading or legend.
- Please refer to the 'Formatting of submission' section for further guidelines.

Article Submission

Submission declaration and verification

With the submission of an article the authors confirm that:

- The work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint). Please see our ethics policy for more information.
- That it is not under consideration for publication elsewhere.
- The content of the article is the sole work of the author(s) and that the article has been prepared with cognisance of our plagiarism policy.
- That its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in any other language.

Prior to submission

- Please familiarize yourself with the policies of the SAOJ.
- Please read Instructions to Authors prior to submission. It will also be beneficial to familiarize yourself with the Instructions for Reviewers section.
- It is the responsibility of the authors, and not the reviewers, to ensure that the language, grammar, or spelling is acceptable for publication.

- Crosscheck all references to ensure that the bibliography is accurate.

Submission procedure

- On submission of your article the ORCID (Open Researcher and Contributor ID) identifier of all authors will be required. ORCID provides a persistent digital identifier that distinguishes you from every other researcher and supports automated linkages between you and your professional activities ensuring that your work is recognized. To register and find more information please visit: <http://orcid.org>
- All correspondence will be sent by e-mail.
- Articles can be submitted by e-mail to: pat@saorthopaedicjournal.com.

REVIEWERS' COMMENTS

Reviewer 1:

Peer-Review of Article:

The FC Orth(SA) final examination's keeper: How effective is the written component?

Recommendations following review:

1) Accepted with minor revision

Summary

- The authors set out to determine the annual pass rate of The FC Orth SA examination and examine the correlation between the written and clinical/oral components.

General comments

- Well written article on a very relevant topic. Well done. Pity we have limited data as you correctly pointed out in the limitations section.
- Authors should check instructions to authors again. A few aspects need to be changed i.e. Conclusion needs to be under a different heading.

Acknowledgements and ethical statement before the references, etc.

Small issues.

Specific Comments:

- Line 68-71: I do not believe the study design lends itself to hypothesis testing. I would omit this section.
- Line 75-76: Why were the results of candidates who were unable to complete the written component excluded from the analysis.
- Figure 3: It would have been interesting to see pass rate for each examination rather than per year. I would have liked to see the variance per centre of examination.
- Line 150: Maybe are testing different aspects of competency... rather than examination skills. Furthermore, It could also indicate a different approach to the marks being given by the examiners when facing the person they are examining. Might be easier to fail someone when they are just a number?
- Line 166: Or it might be that examiners are more strict when it comes to the clinicals

- Line 174: Importantly, it might indicate lack of standardization of the examine between different hosting centres.
- Line 179: Not all our readers are educationalists. Can you please explain the term standard setting.

Reviewer 2

The FC Orth(SA) exam review

P1. Title.

I do not understand "...final examination's keeper:...."

Think title should be "final examinations :....."

P4. 3rd last paragraph ending 'Each case was marked against a checklist by two examiners.'

This statement is not accurate. The short cases are not marked against a checklist, unlike the oral exam in the next paragraph. Also in the same paragraph, it is not correct to say that the short cases are minor cases. They are in fact as major as the long cases.

P9. Last paragraph: "The findings suggests the value of the various components of this examination"

Revise the sentence, it is incomplete.

Fig 2. Caption.

The title on the blue curve is rather confusing. We would normally use the term written attempts in relation to a candidate who rewrites the exam. The narrative on th figure 2 on p.5 of the text is however quite clear on what the blue curve is. Suggest use the same term as in the narrative, like 'no candidates who wrote'

Otherwise a well-written article, excellent discussion of the results.